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Improved Vertical Engine.

The characteristics which have caused the vertical engine to meet with extended favor in steam-ships, are believed by many to be sufficient to entitle it to the same appreciation in other cases, and under different conditions. A stationary engine of this kind possesses in a high degree the essentials of economy in space, avoidance of, or resistance to, strain upon the framing, general durability, and non-liability to derangement of its parts. These and other advantages not necessary to be mentioned here at length, seem destined to bring it into general use for stationary purposes. It has already won its way to universal favor on board our finest screw steamers, where its continuous and rapid working, during long and stormy passages proves it to be peculiarly fitted to sustain severe labor for long periods. As previously intimated there is no other style of engine which occupies so little room, in which the strains are so well resisted by the framing, or in which the friction is so small and the endurance of all the parts so well secured.

The engine shown in the engraving consists of three principal parts: the cylinder, the frame, which is a tapering column of curved outline, having openings in the sides large enough to allow free access to all the working parts within; and the base, which elevates the shaft sufficiently for the fly wheel to clear the floor.

The slides and pillow blocks are cast with the column so that they cannot become loose or out of line; the rubbing surfaces are large and easily lubricated. Owing to the vertical position there is no tendency to side wear of cylinder or piston. The packing rings are self-adjusting and work free or tight.

These engines, of from two to ten horse power, are built in quantities and the parts duplicated by special machinery, (as in fire arms and sewing machines,) which secures great accuracy and uniformity of workmanship, and allows of any part being quickly and cheaply replaced, when worn or broken by accident.

In all sizes above ten horse power (and below if desired), the governor adjusts the main valve to cut off at any point of the stroke by exceedingly simple mechanism, thus securing that economy and regularity which can only be attained by using boiler pressure in the cylinder and the fullest degree of expansion.

The best cut-off engines are well understood to produce remarkable results in economy of steam and uniformity of motion; but from the refinements of their mechanism they require more skillful attendance and more careful adjustment than circumstances will ordinarily allow. Without pretending to equal them fully in either particular, the manufacturers of this improved vertical engine claim to approach very nearly and at the same time to have a more simple, durable and easily-cared-for engine than even the common plain slide valve.

Owing to the simplicity of construction and system of manufacture these engines, of superior quality, are offered at very moderate prices by the manufacturers,

IMPROVED VERTICAL ENGINE.

"The New York Safety Steam Power Company., S. WILCOX, Agent, who may be addressed at No. 44 Courtlandt street, New York City.

The Magnetic Well of Michigan.

Five years ago this Summer, when the oil excitement in this country was running high, some of the citizens of this place caught the fever, and commenced to bore for oil. The circumstance which gave most encouragement to the enterprise was unmistakable developments of petroleum in several springs along the banks of the Belle river, in the vicinity of the villiage, and the show of oil appears to be as good now as then. A company was organized, land leased; machinery and materials purchased, the job of sinking a well was let, and the work commenced.

Heavy seven-inch driving pipe was used for tubing, and this was driven into the earth by nearly the same process that piles are driven, using a saw-log for a driver. The pipe was sent down at the rate of about one-eigth of an inch at each drop of the driver, until a depth of sixty feet was reached, when the lower section was broken, caused, it was believed, by the pipe striking a boulder or the bed rock.

The drill could not be forced further, an account of the crushed pipe obstructing its passage, consequently the company were forced to give up the enterprise or start a new well. At this juncture the faith and courage of most of the company gave out, and the thing was allowed to rest from that time to the present. But they got something more than a dry hole—a flowing well of pure cold water, very pleasant to the taste, with quite a strong mineral flavor.

The water rises in the pipe about six feet above the surface of the ground, and the floods continue to be quite uniform in quantity, except that at intervals of a few seconds the quantity increases, perhaps twenty-five per cent., and then it gradually decreases until its minimum is reached. Gas comes bubbling to the surface continually in small quantities, and the water is so cold, that it is painful to hold one's hand in the pipe for more than thirty seconds.

The water and pipe are strongly magnetic, and will charge knife blades so that they will pick up needles, nails, trunk keys, etc., very quickly. The magnetic influence in the pipe is so strong, that an eight-penny nail may be placed vertically upon the end of the pipe in the current of water. and then two more nails placed upon this, end upon end, and they will stand there unsupported. There is no doubt that this spring is as highly magnetic as any yet found. Its chemical properties are not yet known, as no analysis of the water has yet been made, nor has it been tested as a curative agent. The spring is on the banks of a brook near its junction with Belle river, in the outskirts of the village, and about forty feet below the general level of the country.—*Detroit Press.*

[We have yet to see water that will magnetise a knife-blade through its inherent magnetism. Iron rods and pipes when in a vertical position, often become magnetic by the influence of the earth's magnetism.—EDS.]

Chemical Repertory.--No. 37.

SEPTEMBER 2, 1870.

Editor—HENRY WURTZ.

Editorial.

ON THE CALORIFIC POWER OF HARE'S BLOW-PIPE.

Dr. W. M. WATTS, in his strictures on the discussion of Prof. SILLIMAN and myself of the "*Calorific Powers or Effects of Gases*" (reproduced, with my reply thereto from the *Philosophical Magazine* and the *Chemical News*, in the REPERTORY no. 34, of July 16, 1870), objects to our formula for the total heat of the oxyhydrogen flame, namely—

$$\frac{34462-(9\times 537^\circ)}{4.3245} = 6851^\circ;$$

remarking that "there is an error in assigning to liquid water the specific heat 0.4805, instead of 1. The formula should be—

$$\frac{34462-9\,(637-48.05)}{4.3245} = 6743^\circ."$$

Dr. WATTS's other points were probably sufficiently met in my reply appended to our reproduction of his criticism, but this point was at this time expressly reserved, as looking to considerations which had already led to some little oral discussion between us, and with others.

Having had no opportunity, as yet, for that mature deliberation, in conjunction with Prof. S., that I desired to have, before going into print further on these questions of specific heat, and feeling that delay may cause misconstruction, I have given to them individually such consideration as I have had time for, and have decided to present a reply to Mr. WATTS, in anticipation of our joint reply. In the preparation of the latter, arranged for an early day, any new lights that may appear in the interim, will of course be available.

Previous to the date of the first publication of our joint paper (in this Journal, March 2, 1870) in the course of conversation with Prof. H F. WALLING, he made to me the suggestion that it was possible our formula ought to be so modified as to read—

$$\frac{34462-9(537+51.95)}{4.3245.} = 6743^\circ$$

leading, as will be seen, to the same figure as that of Dr. WATTS. Prof. WALLING, however, expressed himself as by no means *sure* of his view, as he had given no especial study to the subject, and offered it merely as a hypothesis. The apparent coincidence here gives more interest to the subject.

It is to be observed that Dr. WATTS's formula supposes the temperature of the pound of hydrogen started with, in the combustion, to have been zero, and further that each of the nine pounds of water, (as water) must have absorbed and retained 100° of sensible heat. Hence his figure 637°; which he diminishes, however, by 48·05°, for reasons which, as follows from the context, arise out of the difference between the specific heats of water and steam. The only conclusion I can draw from this is that Dr. WATTS believes it requires an absorption of 51°.95 of sensible heat from 1 pound of water at 100°, to convert it into 1 pound of steam at 100°, *plus* the 537° of latent heat generally admitted as the *actual result of experiment*; or, as may otherwise be stated, it follows from Dr. WATTS that the latent heat of steam at 100°, instead of 537°, is really 537° +51.95 = 588°95. I prefer as yet to stand by the experiment, until I receive from Dr. WATTS some clearer explanation.

In the case of Prof. WALLING, whose doubtfully submitted hypothesis also arose out of the consideration of the difference between the specific heats of water and steam, in the first place, it is clear at a glance, that the coincidence in the resulting figure is not accidental; for 637—48.05=537+51.95;

and from this formula it is still more evident that, in addition to the 537° known by experiment to be all the heat that actually becomes latent in the conversion of one pound of water at 100° into one pound of steam at 100°, 51°.95 more must be supposed to become latent, leaving but 48°05 of the sensible heat of the boiling water to remain sensible in the steam, and again increasing the latent heat of steam to the hypothetical number, 588°.95.

There must be a reason for every error (if this be one, as I cannot but conclude), as well as for every truth; and in seeking for the cause of this one, it seems to me to arise from a notion of specific heat, as absolute quantities, instead of mere *ratios*. The name is good, as it means merely that different *species* of matter are differently affected by equal additions of heat; and specific heats are merely the ratios of these differences. When a body changes its state, as from water to steam, the 537° required to produce this change of state produces also a *change of specific heat*. The sensible heat remains unaltered. The 537° must come from external sources. Steam is different in species from water, and possesses a different specific heat ratio. Time fails for a fuller exposition of this subject now.

With regard to our formula for the total heat of Hare's Blowpipe, though Dr. WATTS's correction, as I have endeavored to show, does not appear to me sustainable, there has occurred to me a small correction, necessary to precision, which I shall call attention to, here and hereafter, for the reason that the principle on which it depends, is, in its application to combustible gases, becoming now of practical importance. This is merely a correction for the temperature of the hydrogen before burning, which, for simplicity, SILLIMAN and WURTZ assumed to be zero. If this temperature is the ordinary one of 60° F. (= 15°6 C.), at first glance it might appear necessary merely to add 15°6 to the 34462 in the numerator of our fraction. This would involve an error, however, which, though trifling here, would be very important in cases where the combustible or supporter of combustion is highly heated beforehand. Such cases I will discuss at an early day hereafter. Here I shall merely explain that in the oxyhydrogen flame, we must first calculate the mean of the specific heats of the gases in combustion, thus:

$$\frac{3.409+(8\times 0.2175)}{9} = 0.5721;$$

and we shall then have, instead of 7969°, the figure calculated, in our joint paper, by SILLIMAN and WURTZ, a temperature differing so little therefrom as to be scarce appreciable:

$$\frac{34462+15.6\left(\frac{1}{0.5721}\right)}{43245} = 7975^\circ.$$

The explanation of the details of this calculation I must for the present defer. HENRY WURTZ.

American Chemical News.

PRACTICAL SUGGESTIONS FROM MR. FARMER ON GAS PURIFICATION.

Messrs. Editors: As all the articles in CLEGG and HUGHES, for determining the sizes of purifiers, for dry lime purification, are so very inexplicit, I think the following easy method will be useful to young Gas Engineers:

As one bushel of hydrate of lime will only purify about 1500 cubic feet of the gas (after being well condensed and washed) made from some of the best American coals, I shall take this quantity for the basis in the following formula; though it may be modified if found necessary.

Let n = The number of tiers of trays.
t = " thickness of lime on a tier in inches.
c = " cubic feet of gas to be purified in 24 hrs.
b = " bushels of lime required in 24 hours.
s = " square feet required in a purifier.

To find the quantity of lime required per day.

Formula 1. $\frac{c}{1500} = b.$

This formula, when expressed in ordinary language, gives the following

RULE.—Divide the number of cubic feet of gas made in the 24 hours, by 1500, and the quotient will give the number of bushels of hydrate of lime required per day.

To find the area of each purifier,

Formula 2. $\frac{2150.4\,b}{144\,t\,n} = s$

This result, expressed in ordinary language, gives the following

RULE—Multiply the number of bushels of hydrate of lime required per day, by 2150.4; divide the product by a divisor obtained by multiplying together the number of tiers, thickness of lime on a tier in inches, and 144; the quotient will be the area required in square feet.

I shall now give three different examples.

EXAMPLE 1.

What should be the area of each purifier with seven tiers of trays, and two inches of lime on each tier, to purify 800,000 cubic feet of gas per day.

Per Formula 1. $\frac{800{,}000}{1500} = 533$ bushels of lime.

Per Formula 2. $\frac{2150.4\times 533}{144\times 7\times 2} = 568.53$ square feet.

And $\sqrt{568.53} = 23.8$ feet—length of each side of purifier.

Or 4 purifiers, each 23 feet 9½ inches square, inside measurement, and one purifier to be taken up every 24 hours.

EXAMPLE 2.

What should be the area of each purifier, with seven tiers of trays, and two inches of lime on each tier, to purify 1,500,000 cubic feet of gas per day.

Per Formula 1. $\frac{1{,}500{,}000}{1500} = 1000$ bush. of lime.

Per Formula 2. $\frac{2150.4\times 1000}{144\times 7\times 2} = 1066\text{-}66$ sq. ft.

And $\sqrt{1066\cdot 66} = 32.66$ feet—length of each side of box.

Or 4 purifiers, each 32 feet 8 inches square, inside measurement, and one purifier to be taken up per day.

As these purifiers will be rather too large to be convenient, they may be divided into two sets, consequently each purifier will only require to be af half this area.

Therefore $\frac{1066.66}{2} = 533.33$ square feet

And $\sqrt{533.33} = 23.09$ feet—length of each side of box.

Or 8 purifiers, each 23 feet 11 inches square, inside measurement, and 2 purifiers to be taken up daily.

EXAMPLE 3.

What should be the area of each purifier, with six tiers of trays, and two inches of lime on each tier, to purify 2,400,000 cubic feet of gas per day.

Per Formula 1. $\frac{2.400.000}{1500} = 1600$ bus. of lime.

Per Formula 2. $\frac{2150.4\times 1600}{144\times 6\times 2} = 1991.11$ sq. ft.

This area had better be divided into three sets of purifiers.

Therefore $\frac{1991.11}{3} = 497.77$ square feet.

And $\sqrt{497.77} = 22.31$ feet—length of each side of purifier.

Or 12 purifiers, each 22 feet 3⅜ inches square, inside measurement, and 3 purifiers to be taken up daily.

For small gas works, that are intended to be run without an exhauster at first, it will be better to calculate the purifiers for five tiers, and the lime on each only one inch thick, so as to reduce the back pressure on retorts as much as possible; and then by and by, when the work increases, and an exhauster is required, the thickness of lime on trays may be raised to two inches, and thus increase the working capacity of the purifiers.

In determining the size of purifiers, especially for some stone limes, it is of the greatest importance to give them ample area.

A set, consisting of only two boxes, is a very extravagant method of purifying gas, as the purifying property of the lime is far from being exhausted when the purifiers have to be taken up, and the lime thrown away.

For instance, if the first purifier stains at 8000 cubic feet, the second purifiers will stain at about 24,000 cubic feet, if the first box, after it has stained could be left on to work with it. A set consisting of four purifiers will be found to give the best results.

To find the Diameter of Pipes for Purifiers.

Multiply the constant number .80 by the square root of the area of the purifier in feet, and the quotient will give the diameter of the pipes in inches.

EXAMPLE.

Suppose the area of one of these purifiers is 625 sq. feet, what should be the diameter of the pipes?

Hence $\sqrt{625}\times .80 = 20$ in.—diameter of the pipes.

For large works, the cups for seals should not be less then 16 inches deep and 3 inches wide; and the tank for a wet centre seal should be 32 inches deep, or just twice the depth of cup on the purifiers.

For small works, with one or two light holders 12 inches may do for the depth of cups, and 24 inches for the depth of tank for wet center seal.

The measure used in these formulæ, is the United States standard bushel, which contains 2150.4 cubic inches. WILLIAM FARMER.

New York, August 10, 1870.

CHEMICAL EXCERPTA.

L'Academie des Sciences.

The Supposed Absolute Zero of Heat.—A controversy has been in progress before the Academy (see *Comptes Rendus*, lxx, pp. 1310, 1377, etc.) between the two eminent members, Jamin and H. St. Claire Deville, of rather an energetic character, in the course of which we may expect some important light to be thrown upon the interesting questions of the existence or possibility of an absolute zero, or in the language of the mechanical theory of heat now in vogue, a temperature so depressed that the heat vibrations of the molecules altogether disappear, and no further cooling is possible. At the session of June 27, 1870, Deville shows that Jamn has imperfectly quoted, thereby altering the sense of one of his own former papers, upon the variations of temperature by mixture of liquids, printed ten years since (March 12, 1860) in the *Comptes Rendus*. On this he comments very sharply and justly in a note. "When an author is cited *textually*, or in an incomplete manner, the sources of such citations should always be exactly indicated (a truism indeed!); adding that the suppression by M. Jamin of six words, by destroying the relation of the quotation to the very subject of the memoir quoted, imposed upon himself a tedious search in the discovery and identification of his own words. Deville proceeds to complain that Jamin has applied to this memoir the following language: 'These hypotheses are unfortunately slightly vague; they establish no numerical relation between the facts and the explanation, and are destitute of experimental sanction. I come to submit in my turn to the Academy a new idea which seems to me of a nature to facilitate the solution of this important question." Part of Deville's scientific creed being, as is well known, a holy horror of *hypothesis* (although we humbly venture to submit that all our accepted *theories*, throughout all human science, must *once* have been but hypotheses, and subject, as such, to long and painful controversy, on the part of the advocates of antagonistic hypotheses, before they could be established) his gorge rises at this, and he says: "The *war* that I make upon hypotheses leads me naturally to consider that of the absolute zero, an abstraction, a mathematical fiction, useful in the mechanics of heat, but which can be applied but conditionally." Thus premising, he essays to turn the tables on M. Jamin by showing that his mathematical expression involves this abstract and certainly altogether speculative hypothesis of an absolute zero. He adds that M. Hautefeuille and himself are now much engaged in experimental researches bearing on this very subject. Jamin, at the last accounts, having promised a rejoinder to Deville, we shall return to this subject when the controversy shall have been closed, as it cannot fail, if pursued, to contribute to the clearing up of some of our notions, at present certainly much confused, regarding the facts and principles classed together under the head of Specific Heats.

H. W.

New Chemical Relations of Silica; *interesting and important in Agriculture, as well as in Geology and Mineralogy.*—Friedel and Ladenburg recently announced to the Academy (*Comptes Rendus* lxx, 1407) certain new organic compounds containing silicon in their constitution, among which was what they called *silicopropionic acid*, containing in its constitution, with silicon and hydrogen, the organic radical *ethyle*. This new compound is formulated by them according to ideas which we will not stop to discuss; our interest attaching chiefly to its chemical properties and relations. They say it "much resembles silicic acid, but is easily distinguished by its combustibility, burning like tinder when heated." It is insoluble in water, but readily soluble in warm concentrated potash. It appears to be a feeble acid analogous to silicic acid, and "is, in fact, the first carburetted silicic acid." The authors say that "it constitutes one term of a series of homologous acids," of which others will be obtainable by like processes. Dumas, in commenting on this paper, threw out the speculative conjecture that as "there are so often found in nature silicious matters containing traces, more or less sensible, of organic matter, it would not be surprising that, just as at times natural compound ammonias have been confounded with ordinary ammonia, so compound silicas, in nature, may have been regarded as ordinary silica. In response to this conjecture came a communication from Paul Thenard, of a most striking, surprising, and suggestive character, being the preliminary, though quite extended announcement, of the discovery that certain modifications of the substances of the humic acid group *have the power to dissolve silica in large quantity*. These new silicious solvents are produced by fixing ammonia upon the humic matters, in ways not yet explained, by which the ammonia is not merely combined as a salt, but enters into the molecular constitution. He has thus formed four distinct derivatives of the humic type, which are not alkaline but acid, and he calls them *acides azhumiques*, which we must render into English as *nitro-humic acids*. Their fixity is remarkable, as they do not wholly lose their nitrogen at 1000 deg. to 1200 deg. They combine with silica to new acids, *siliconitro-humic* acids, which are instantly dissolved by alkalies, including ammonia, even when very weak, forming salts, from which the siliconitrohumic acids may be recovered in all their integrity. The proportion of silica taken up is in proportion to the amount of nitrogen present, varying from 7.5 to 24 per cent. A new relation is here indicated between silicon and nitrogen. Thenard finds these nitrohumic acids in soils, and attributes the silica always found in solutions of the acids of soils to this cause. [We have demonstrated thus, at once, a theory, not only of new relations of plant-decay to plant nutrition, but also of the far broader subject of the transformation and migration of silica throughout all past geological ages, and of the continual, and (as the writer of this abstract has long believed) *sole* agency of Life in these, as in the past and present migrations and transformations of carbon. More of this though in another place.—H. W.]

Thenard concludes by saying that he does not confound his new "organo silicated" bodies with the organic compounds of Friedel, in which latter silicon plays the part (takes the place?) of carbon. He adds that Friedel has seen his own new bodies.—H. W.

Practical Management of Gas Works.

By James R. Smedberg.

[Written expressly for this Journal.]

NUMBER VIII.

From the Retort House the gas passes to the condenser. For some years the precise conditon of the exhauster has been considered a matter of little importance, if it only preceeded the Lime Purifier; and there was high authority for placing it next the Hydraulic Main, from the arguments that by so doing, we secured a closer grip upon the difficulty it is intended to remove, and that the hot tar acted as a lubricator upon the moving parts.

The back-pressure of the multitubular condenser is, however, so slight, as to be unworthy of consideration; and the tar acts really to clog instead of to lubricate, the exhauster. In fact, the "double-eight" Exhauster formerly—and, perhaps, still—in use at the Manhattan's Fourteenth street Station, formed so hard a crust of some chemical enormity upon its rolling face, that a minute stream of gasoline had to be employed as a solvent. And as to the advantage of proximity to the Hydraulic Main, I will presently mention a device which replaces the wasteful compensator, and disposes finally of the "air-contamination" question.

Returning to the condenser; if we take the excess of temperature at only 50 deg. Fahrenheit, an immersed condenser has, by Peckler's table, a power, per unit of surface, *two hundred and fifey three times greater* than one standing in air, be the latter ventilating or non-ventilating; and as this excess is usually more than 50 deg. Fahrenheit in most large works, and as this progress of power is *geometric*, not direct, the superiority of an immersed condenser becomes simply enormous.

The following modification should, however, be made in the condenser. Perhaps it has already been adopted; if so, I cordially yield its merit to the promoter.

At present, a portion of what tar is condensed between the water-surface and the covers settle into the water. It there largely interferes with the cooling power of the latter, and form a tough deposit (except immediately at the water-inlet) which is simply gradual paralysis of the condensing functions. This has recently been noticed in cleaning the King street Condenser of the San Francisco Works; a condenser, by the way, unprovided with lateral stay-rods, or cleaning holes for the tank of immersion. From the want of stays, the side-plates of this tank actually gave way under the water-psessure, and a pleasant time generally ensued: and this pleasantness was intensified by the want of an independent sealing cap for the covers, causing the continued stoppage of the works after the repairs were finished, while some 7,000 gallons of water were flowing into the tank.

I propose to have an *upper*, as well as a lower, tar-box, the water-space being intermediate, and entirely shut off from any influx of tar, by a horizontal diaphragm, closely jointed to the sides of the condenser, and to the vertical pipes, at a distance of a few inches from the top of these last—this "tar shelf" to deliver through a goose neck inserted at or just above its level.

And the importance of an independent water lute cannot be too strongly urged; for when a large station has to be stopped, a minute seems like a week, and an hour belittles a century of common events.

We here leave the condenser, its general construction having been already discussed; only remarking that all large works should be provided with boilers, engines, and exhausters *in duplicate*.

The Exhauster supplied by the Smith & Sayre Manufacturing Company is an admirable machine, and leaves little room for improvement. Perhaps a slight ellipticity of gear might add to the smoothness of gas flow, but I throw this out only as a hint; not as a positive statement.

THE COMPENSATOR.

The Compensator is intended to supply the Exhauster, if accidently over speeded, with an additional volume of gas which has once passed, instead of permitting the excess of vacuum to be reduced by the flow of air; which, in such a case, will always take place through mouth-piece joints etc. It enables you to pump your gas twice, and that is about all.

Now, an Exhauster and Compensator in the hands of a novice, are about as destructively useful as one of Wade & Butcher's best in the chubby paw of a prize baby; to whom let us wish all happines as we go on. Before I found out that when you let down a bench you must reduce your counterbalance weights, swift were the revolution of my Station Meter, and loud the plaints of an overated public. Air went into my pipes because, through any pin-hole, air goes into emptiness; and intermittent emptiness had been created through the all-working action of what, I flatter myself, was supreme stupidity.

So I wish to tumble every compensator into some ignoble scrap heap, and formally call on every right-minded engineer to abolish, utterly and forever, an instrument which wastes fuel and temper, and is indefensibly, about as abominable a nuisance as perverted ingenuity hath yet devised.

THE BEGGS EXHAUST GOVERNOR.

Instead of a Compensator, Mr. James Beggs, Managing Engineer of the San Francisco Gas Company, recommends a small gas holder, suitably floated, the rise and fall of which actuates the engine-throttle, while into the interior opens a single independent vacuum-and-pressure pipe communicating with the Hydraulic Main. The principle of its action is precisely that of the pressure-register, and will be fully explained, with sketches, in my next.

It will be seen that this Exhaust Governor is absolutely automatic. You can float your governing holder up to ten times the natural scale if you will, and with a drum 4 feet in diameter, secure the most delicately unerring speed to the Exhauster. And so may your engine man sleep placidly by night, while the swift and ethereal hydro carbons make their ownselves behave themselves.

In works making 1,000,000 cubic feet per diem, the actual duty of the exhauster is to raise 40,000 feet of water, one foot high per hour, or say 42,000 lbs. one foot high per minute. Exterminate the Compensator, and all you want is, by theory, 1¼-horse power, or practically 2-horse power, per million cubic feet per day.

Note.—Applications have been made for Patents upon the use of the "Tar Shelf" in the Condenser, and for the device of the Exhaust Governor.

On Setting and Working Retorts.

(*Continued from page* 53.)

It is considered a matter of great importance with some gentlemen, that all the coals delivered into the retort-house be wheeled over a weighing-machine and weighed; and I have heard it referred to with evident self-satisfaction, as being the proper thing to do—as being, in fact a cleverly devised kind of tell-tale for keeping the stokers up to their work. There is a given weight to go into each retort per 24 hours, and therefore the coals weighed into the house must be equal to such given weight per retort, multiplied by the number of retorts in action, multiplied by the number of charges. Now, I am sorry to have to say anything disrespectful about such a (generally) harmless hobby as this; but truth compels me to observe that I think its utilty is on a par with the other innocent amusement of peeping into the bed through cast-iron boxes with moveable lids built in the front wall for that purpose, the ostentible object, I presume, being to enable the manager to ascertain if the heats of the retorts are satisfactory. This perennial peeping observance is discharged by some of its devotees with a scrupulousness worthy of a better cause, and highly suggestive of fire-worshipping, or, at any rate, of conviction that it is esential for the proper and conscientious performance of one's duties. Well, I cannot say I am sceptical as to this doctrine, because I have no doubts on the matter. I know (and I have already endeavoured to explain why) that wherever there is room between the retort for indulging in these playmates, there is unquestionably something radically wrong with the construction of the setting; and I have almost invariably found that their concomitant is the

presence of rich hydrocarbon vapors in the neighbourhood of the tar well. But it is an ill wind that blows nobody good. These same sight-boxes are worth, I was going to say, their weight in gold to the fortunate tar distiller. I have a strong conviction that all this coal-weighing and sight-seeing is, to say the least of it, supererogant. A manager can always satisfy himself, by a glance at the production per retort in the carbonizing book every morning, whether things are going on satisfactorily in the retort-house; and this part of his duties at any rate, ought not be omitted. If there has been a proper make per mouthpiece for the proceeding 24 hours he may rest quite satisfied; if otherwise, looking through a sight-hole, at any rate will not mend matters. The public, we all know, have a settled conviction that the matter goes around by itself, apart from any consideration of the motive power of the gas—that it is in fact, a disagreeable kind of solution of the perpetual motion problem; but gas managers, being more enlightened, ought to have faith in the fact that the retorts will not make the desired quantity of gas, unless there be sufficient coals put therein, and the heat be equal to its distillation.

It is scarcely necessary to discuss the question of stage *versus* ground floor for working the retorts from, because the stage system is almost exclusively confined to London and its neighbourhood. The advantages claimed for this system are, as far as I understand, that the barrowmen do not require to go out of the high temperature of the retort-house, in cold or wet weather in wheeling out the coke drops down out of the stoker's way in drawing, and that extra storeage for it is obtained. But, if I may have the temerity to say so, these advantages are so dearly bought, and are so equally balanced by disadvantages, that it seems to me that the system is only justifiable where sufficient yard room is not procurable. The question of the barrowmen's comfort could easily be met, if desired, by covering in the coke-ground with an open shed. As to the additional storeage room obtained, it would, even if the whole space could be filled up to the stoking-floor, be but a mere bagatelle in cubic capacity. But that cannot be done or anything like it. Indeed, the whole of the floor cannot even be covered with coke, and on no part of it can there be such a depth as to sensibly affect the yard storeage. And to obtain these nominal advantages the retort-house wall and chiminey, or chimneys, have to be carried the additional height of the stoking from the ground floor, with more expensive foundations. There is the extra cost of the stage or stoking-floor, while the timber and consequent cost of the arches or ovens is just doubled—that is to say, for each effective arch set with retorts there is another one of equal size built for the express purpose of supporting the former, and which is otherwise almost useless. Nor is this serious and otherwise avoidable first outlay the only disadvantage. The coke is unnecessarily smashed in all going so far and, after all, it has to be handled quite as much, if not more than if it were drawn out of the retorts into a barrow, and wheeled on to the coke heap in the yard at once. Men have to be kept below to quench and remove it out of the way of the next charge; after that they fill it into sacks, and in some places actually carry it outside to the vans. And over and above all this, practical men, like those I have the honnor of addressing, will readily understand that with a space of more or less width between the front of the stage and the retort-bench, and with the furnace-bars usually below the stage level, there cannot be the same facility in working as on the ground floor. Again the proportion of the coke required for fuel must either be prevented from falling on to the floor below in drawing, or it must be carried back again. So that, all things considered, I for one fail to see any appreciable advantage in the stage system.

As to the question of furnace combustion which plays such an important part in gas-making, I have left myself but little time to speak. Moreover, it is a question of sufficient importance for a seperate paper, and one that I hope some member of this association will take up and treat at next year's meeting. Where coke is used as retort fuel, there is comparative immunity from trouble with this question, but it is otherwise where coal or tar is used for that purpose. In the former case complete combustion is easily ensured, because not only is there but one element to be dealt with, but from the coke being in large pieces the fire-bars can be set wide enough apart to give ample area for the admission of air, while the portion of the coke next the furnace-bars, by its open porous nature, acts as an admirable filter or sieve, breaking up the air into finely divided threads, and so bringing each atom of carbon into immediate contact with its equivalent of oxygen But where coal is used, especially small coal or slack, requiring the furnace bars to be kept very close, perfect combustion becomes a much more difficult matter, because the element into which the coal is resolved require each its own equivalent of air, To quote an extract from Wye Williams, "Each pound of good coal will give out 5 cubic feet of gas, and require for its special use 50 to 60 cubic feet of air according to the quality of gas; while the remaining coke, being about 50 to 60 per cent. of gross weight of the coal, will require about 100 to 120 cubic feet. The products from each hundredweight, then, in round numbers, will be as follows:—

Hydrogen	5 lbs.
Carbon in combination with the hydrogen, and forming gas	20 "
Carbon remaining as coke	60 "
Nitrogen, sulphur, oxygen, and ashes	15 "
Total	100 "

We here distinguish three bodies into which the coal is resolved, and each requiring its own special equivalent of air—viz, the coke, the hydrogen, and the carbon of the gas. Now, the whole question of perfect or imperfect combustion—the utilization of all the element of the coal, and obtaining their relative and entire calorific effect will be determind exclusively and absolutely by the facilities afforded these three bodies in obtaining their respective contract and quotas of their supplies. It will not be enough therefore, for engineers to look to the naked fact that each pound of coal will require 150 cubic feet of air, and to expect that all the contingencies of combustion will be satisfied if they provide that quantity. So far from that being the case, it is exclusively on the special application of these 150 cubic feet to these three separate portions of each pound of coal as above described that success will depend For if the air be taken up by the incandescent coke (and to which it first finds access) more rapidly, or in greater quantities, than the gaseous matter can simultaneously be supplied with its own due quantity, the entire operation in the furnace will be deranged. In a word, the gas should have its own equivalent of air, and enter into combusion as rapidly as it is generated, and in due relation to the combustion of the coke in equal times." It will be thus seen that it is absolutely necessary to produce means for an adequate supply of air, in addition to what is drawn through between the furnace-bars to obtain the full calorific effect of the fuel, and that the finer the suplementary supply of air is divided and commingled with the gaseous product of the coal, the more perfect will be the combustion. And this is as indispensable for the proper combustion of tar as it is for coal.

An efficient and convenient mode of burning tar is represented in the drawing of the six retort setting exhibited. It is a copy of Mr. Anderson's tar fire, with the addition of a furnace below the sloping table, on which the stream of tar falls, for the purpose of keeping it hot, so that the tar may be volatilized directly it comes in contact with it.

Mr. Anderson effects this by means of the combustion in a chamber below of the resultant fine breeze from the tar itself. But I have found that the addition of the furnace saves a good deal of tronble in attending to the fire at the cost of but an insignificant consumption of breeze. It will be observed that finely perforated plates with sliding doors are built into the front wall, for the purpose of regulating the admission of air. Tar cannot be burnt, without destroying the retort placed over the fire, before the others are worn out as they are usually set, but when arranged as in the setting of six circulars illustrating the tar fire, and also shown in one of the of seven ovals' this difficulty is entirely obviated, and tar can be burnt without undue destruction to the retorts, and without the production of smoke. I have burnt tar produced from both Newcastle and inland coals off and on for a good number of years, and the result of my experience is, that when consumed under proper condition, it does the work of just about twice its weight of coke, or, in other words, five gallons of tar are equal in heating properties to a sack of coke. But whether coal or tar be used as fuel, there is no difficulty in ascertaining whether they are doing their work properly. The condition of the retorts will speedily show that, and there is in addition the tell-tale of the chimney top. If there be an absence of smoke by day and flame by night, it may be taken for granted that the furnace combustion is satisfactory. In the larger gas works in Scotland, the residue of the tar after distillation, is used in a liquid state as retort fuel, sometimes in addition to coke, and sometimes by itself. I have seen it so used very efficiently both at Perth and Dundee. Mr. Whimster, of the Perth Gas-Works, has for many years burnt tar very successfully without any special furnace. It is merely run in over an ordinary coke fire by means of a small iron trough, in the old fashioned way, the regulation of the air admitted by finely perforated iron plates above the furnace frame effecting complete combusion.

[To be continued.]

Mr. Wideman, of the New York Gas Co., states, although we have heard nothing of it in the Pennsylvania oil regions, that the use of oxygen in renewing and increasing the flow of oil in petroleum wells, has been so successful, that a regular trade has sprung up in oxygen gas for this purpose. The gas is injected into the wells through tubes, and mingling with the hydro carbon vapors, forms an explosive mixture which, when ignited, completely opens seams which have become clogged, and thus renews the flow.

The Chemical History of a Candle.

BY PROFESSOR FARADAY.

[A course of Six Lectures delivered before the ROYAL INSTITUTION of Great Britain.]

LECTURE III.

PRODUCTS: WATER FROM THE COMBUSTION—NATURE OF WATER—A COMPOUND—HYDROGEN.

I dare say you well remember that when we parted we had just mentioned the word "products" from the candle. For when a candle burns we found we were able, by nice adjustment, to get various products from it. There was one substance which was not obtained when the candle was burning properly, which was charcoal or smoke, and there was some other substance that went upward from the flame which did not appear as smoke, but took some other form and made part of that general current which, ascending from the candle upward, becomes inviable and escapes. There were also other products to mention. You remember that in that rising current having its origen at the candle, we found that the part was condensible against a cold spoon, or against a clean plate, ar any other cold thing, and part was incondensible,

We will first take the condensible part and examine it, and strange to say, we find that that part of the product is just water—nothing but water. I last time spoke of it incidentally, merely saying that water was produced among the condensible products of a candle; but, to-day, I wish to draw your attention to water, that we may examine it carefully, especially in relation to this subject, and also with respect to its general existence on the surface of the globe.

Now, having previously arranged an experiment for the purpose of condensing water from the products of the candle, my next point will be to show you this water, and perhaps one of the best means that I can adopt for showing its presence to so many at once, is to exhibit a very visible action of water, and then to apply that test to what is collected as a drop at the bottom of that vessel. I have here a chemical substance discovered by Sir Humphrey Davy, which has a very energetic action upon water, which I shall use as a test of the presence of water. If I take a little piece of it—it is called potassium, as coming from potash—if I take a little piece of it, and throw it in that basin, you see how it shows the presence of water by lighting up and floating about, burning. I am now going to take away the candle which has been burning underneath the vessel containing ice and salt, and you see a drop of water—a condensed product of the candle—hanging from the under surface of the dish. I will show you that potassium has the same action upon it as upon the water in that basin in the experiment we have just tried. See it takes fire and burns in just the same manner. I will take another drop upon this glass slab, and when I put the potassium on it you see at once, from its taking fire, that there is water present. Now, that water was produced by the candle. In the same manner, if I put this spirit lamp under that jar you will soon see the latter become damp from the dew deposited upon it—that dew being the result of combustion; and I have no doubt you will see, by the drops of water which fall upon the paper below, that there is a good deal of water produced from the combustion of the lamp. I will let it remain, and you can afterwards see how much water has been collected. So, if I take a gas lamp and put any cooling arrangement over it, I shall get water—water being likewise produced from the combustion of gas. Here, in this bottle, is a quantity of water—perfectly pure, distilled water, produced from the combustion of a gas lamp—in no point different from the water which you distill from the river, or ocean, or spring, but exactly the same thing. Water is one individual thing, it never changes. We can add to it by careful adjustment, for a little while, or we can take it apart and get other things from it; but water, as water, remains always the same, either in a solid, liquid, or fluid state. Here again [holding another bottle] is some water produced by the combustion of an oil lamp. A pint of oil, when burnt fairly and properly, produces rather more than a pint of water. Here, again, is some water produced by a rather long experiment, from a wax candle. And so we can go on with almost all combustible substances, and we find that if they burn with a flame as a candle, they produce water. You may make these experi-

ments yourelves; the head of a poker is a very good thing to try with, and if it remains cold long enough over the candle, you may get water condensed in drops on it; or a spoon, or ladle, or anything else may be used, provided it be clean, and can carry off the heat and so condense the water.

And now—to go into the history of this wonderful production of water from combustibles, and by combustion—I must first of all tell you that this water may exist in different conditions, and although you may now be acquainted with all its forms, they still require us to give a little attention to them, for the present, so that we may perceive how the water, whilst it goes through its Protean changes, is entirely and absolutely the same thing, whether it is produced from a candle by combustion, or from the rivers or ocean.

First of all, water when at the coldest is ice. Now we philosophers—I hope that I may class you and myself together in this case—speak of water as water, whether it be in its solid, or liquid, or gaseous state—we speak of it chemically as water. Water is a thing compounded of two substances, one of which we have derived from the candle, and the other we shall find elsewhere. Water may occur as ice; and you have had most excellent opportunities lately of seeing this. Ice changes back into water; and on our last Sabbath we had a strong instance of this change by the sad catastrophe which occurred in our own house, as well as in the houses of many of you. Ice changes back into water when the temperature is raised; water also changes into steam when it is warmed enough The water which we have before us as ice, is in its densest state, and although it changes in weight, in condition, in form, and in many other qualities, it is still water; and whether we alter into ice by cooling, or whether we change it into steam by heat, it increases in volume—in the one case very strangely and powerfully, and in the other case very largely, and strangely and wonderfully. For instance, I will now take this tin cylinder, and pour a little water into it, and seeing how much water I pour in, you may easily estimate for yourselves how high it will rise in the vessel; it will cover the bottom about two inches. I am now about to convert the water into steam, for the purpose of showing to you the different volumes which water occupies in its different states of water and steam.

Let us now take the case of water changing into ice; we can effect that by cooling it in a mixture of salt and pounded ice—and I shall do so to show you the expansion of water into a thing of larger bulk when it is so changed. These bottles [holding one] are made of strong cast iron, very strong and very thick—I suppose they are the third of an inch in thickness; they are very carefully filled winh water so as to exclude all air, and then they are screwed down tight. We shall see that when we freeze the water in these iron vessels, they will not be able to hold the ice, and the expansion within them will break them in pieces as these [pointing to some fragments] are broken, which have been bottles of the same kind. I am about to put these two bottles into that mixture of ice and salt for the purpose of showing that when water becomes ice, it changes in volume in this extraordinary way.

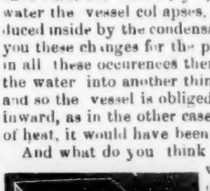
In the meantime, look at the change which has taken place in the water to which we have applied the heat; it is losing its fluid state. You may tell this by two or three circumstances. I have covered this glass flask—in which water is boiling—over with a watch glass. Do you see what happens? It rattles away like a valve chattering, because the steam rising from the boiling water sends the valve up and down, and forces itself out, and so makes it clatter. You can very easily perceive that the flask is quite full of steam, or else it would not force its way out. You see also that the flask contains a substance very much larger than the water, for it fills the whole of the flask over and over again, and there it is blowing away into the air; and yet you cannot observe any great change in the bulk of the water, which shows you that its change of bulk is very great when it becomes steam.

I have put our iron bottles containing watea into this freezing mixture that you may see what happens. No communication will take place, you observe, between the water in the bottles and the ice in the outer vessel. But there will be a conveyance of heat from one to the other, and if we are successful—we are making our experiment in very great haste—I expect you will by-and-by, so soon as the cold has taken possession of the bottles and their contents, hear a pop on the occasion of the bursting of the one bottle or the other, and when we come to examine the bottles, we shall find their contents masses of ice partly inclosed by the covering of iron which is too small for them, because the ice is larger in bulk than the water. You know very well that ice floats upon water; if a boy falls though a hole into the water, he tries to get on the ice again to float him up. Why does the ice float? Think of that and philosophize. Because the ice is larger than the quantity of water which can produce it, and therefore the ice weighs the lighter, and the water is the heavier.

To return now to the action of heat on water. See what a stream of vapor is issuing from this tin vessel. You observe, we must have made it quite full of steam to have it sent out in that great quantity. And now, as we can convert the water into steam by the application of heat, we convert it back into liquid water by the application of cold. And if we take a glass or any other cold thing, and hold it over this steam, see how soon it gets damp with water; it will condense it until the glass gets warm—it condenses the water now running down the sides of it. I have here another experiment to show the condensation of water from a vaporous state back into a liquid state, in the same way as the vapor,

one of the products of the candle, was condensed against the bottom of the dish and obtained in the form of water; and to show you how truly and thoroughly these changes take place, I shall take this tin flask, which is now full of steam, and I shall close the top. We shall see what takes place when we cause this water or steam to return back to the fluid state by pouring some cold water on the outside. [The lecturer poured the cold water over the vessel, when it immediately collapsed.] You see what has happened. If I had closed the stopper and still kept the heat applied to it, it would have burst the vessel; yet, when the steam returns to water the vessel collapses, there being a vaccum produced inside by the condensation of the steam. I show you these changes for the purpose of pointing out that in all these occurences there is nothing that changes the water into another thing; it still remains water, and so the vessel is obliged to give way and is blown inward, as in the other case, by the further application of heat, it would have been blown outward.

And what do you think the bulk of that water is when it assumes the vaporous condition? You see that cube [pointing]; it is a cubic foot. There, by its side, is a cubic inch, it is square, exactly the same shape as the cubic foot, and that bulk of water [the cubic inch] will make that bulk [the cubic foot] of steam, and the application of cold will contract that large quantity of steam into that small quantity of water. [One of the iron bottles burst at that moment.] Ah! There is one of our bottles burst, and here you see is a crack down one side, an eighth of an inch in width. [The other now exploded, sending the freezing mixture in all directions.] This other bottle is now broken; and although the iron was nearly an inch thick, the ice has burst it asunder. These changes always take place in water; they do not require to be always produced by artificial means, we ony use them here because we want to produce a small winter round that little bottle, instead of a large one. But if you go to Canada or to the north, you will find the temperature there outdoors will do the same thing as has been done here by the freezing mixture.



[To be continued.]

Monthly Report of the Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspection for the month of June, 1870:

"During the month, 508 visits of inspection have been made; and 993 boilers examined, 896 externally, 267 internally; and 117 have been tested by hydraulic pressure. The number of defects in all discovered, 371, of which 51 were regarded dangerous. These defects in detail were:—Furnace out of shape, 11 Fractures in all, 36—10 dangerous. Burned plates, 40—4 dangerous. Blistered plates, 62—2 dangerous. Cases of sediment and deposit, 61—2 dangerous. Cases of incrustation and scale, 94—5 dangerous. Cases of external corrosion, 15. Cases of internal corrosion, 9. Cases of internal grooving, 6. Water gauges out of order, 12—2 dangerous. Blow-out apparatus out of order 9—4 dangerous Safety-valves overloaded and out of order, 44—7dangerous. Pressure gauges out of order, 78—2 dangerous; varying from—47 to+25. These extreme variations are unusual, and result from allowing the gauge to run for years without examination or test. A variation of 10 or 15 pounds in either direction is not uncommon, but these should be corrected, and appliances that are so important and upon which so much dependance is placed, should be correct beyond a doubt. Boiler without a gauge, 1. Cases of deficiency of water, 7—5 dangerous. Broken braces and stays, 10—6 dangerous. Boilers condemned, 9. It will be noticed above that there have been 40 cases of burned plates found among the boilers examined this month. In several instances, these have arisen from gross carelessness. Sediment had been allowed to accumulate and the burning was inevitable. In two instances, the boilers leaked badly, and in the morning the fireman, instead of trying his gauge-cocks when he entered the boiler-room, unbanked and replenished his fires. The water having nearly all leaked out of the boiler during the night, the sheets over the fire were entirely ruined and expensive repairs were necessary. The first duty of a fireman on entering the boiler-room is to ascertain where the water is in the boilers. If there is sufficient then replenish the fires. Sediment will accumulate more or less in nearly all boilers. The quantity and character of the deposit may be ascertained by blowing down a few inches each day. If the accumulation is slight, tnes may be all that is necessary for months; but, if there are indications of a deposit that cannot thus be removed, the boiler should be blown entirely down, at least once in two *weeks*, and all sediment removed either through the manhole or handholes. Let the work be thoroughly done, and there will be a saving in fuel, as well as in prolonging the working age of the boiler."

Gas from Peat.

Gas of an excellent quality, for illuminating purposes, and in large quantities, can be produced from some kinds of peat; and in the ordinary progress of events, it is undoubtedly destined to be extensively used for this purpose, and that at no distant day.

This opinion is freely expressed by those who have given most attention to the subject, and the reasons stated are, the quality and quantity of the gas produced, and the low cost of the material, when compared with the coals at present mostin use.

Numerous reports have been published from time to time, but a single statement will suffice to illustrate here.

A gas company, who have recently had a quantity of peat from our works at Lexington, used it with the same amount of cannel coal, i. e., half coal and half peat, and the certificate of their chemist shows a product of illuminating gas of twelve candle power, of 14,376 cubic feet to the tun.

The quantity of illuminating gas ordinarily obtained from the coal mostly used for that purpose in this country, is understood to be from 4000 to 5000 cubic feet, and rarely exceeds 7000 to 8000 cubic feet per tun.

For making and refining iron, the gas produced from peat has been extensively used in France, Germany, and Sweden.

In many places it is used for both these purposes, and its consumption is steadily increasing.

It is distinctly claimed for the Siemen's Regenerative Furnace, that it is especially adapted for the successful and economical treatment of metals and glass by the use of *peat fuel*—a statement of no light importance, in view of the fact that this furnace is now adopted and successfully operated, and its superior merits acknowledged by the most important of the iron, steel, and glass manufactories, in both Europe and America.—*Leavitt on Peat Fuel.*

[Mr. Leavitt is quite mistaken as to the quantity of gas usually obtained per tun of coals. It ranges from 8,000 to 12,000 cubic feet.—Eds.]

Economizizg fuel—A patent device for economizing fuel has been put into the Lewiston mills. It consists of a hopper and a mill for grinding coals, reducing the fuel which is carried by the blower into the furnace with air enough to produce immediate combustion The coal dust leaps into flame like a flake of powder. It is claimed that this device saves 33 per cent. of the expence of making steam. It is said that steam can be generated in one-half the time required by the ordinary use of fuel.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

Commendatory Opinion of Our Patron.

LAWRENCE, KANSAS, August 9, 1870.

Messrs. Editors: Please find enclosed P. O. money order for another year's subscription for your valuable paper. It has continued to come to hand regularly throughout the past year, and I always look for its coming with a great deal of pleasure.

I have taken a great interest in the discussions that have appeared in relation to "Clay or Iron Retorts," and also the articles on "Purification," especially the one in your last number.

It may be of interest for you to know that "Fruitful Kansas," formerly known as "Bleeding Kansas," furnishes coal that yields four feet with iron retorts.

Respectfully yours,
GEORGE A. FARWELL, Sup't.

Gas Companies in Indiana.

TERRE HAUTE, IND., August 17, 1870.

Messrs. Editors: It may prove an item of interest to some to have a list, the best I could obtain, of the gas companies in Indiana. Those marked with an asterisk are on the Ohio River, and of course, can procure coal at cheaper rates than others less favorably situated. Price includes government tax.

	No. Private Consumers.	Pub. Lamps	Miles of Main.	Price per 1000.
Indianapolis	2142	976	34	$3.20
*Evansville	700	234	10	3.70
Terre Haute	627	225	9½	4.00
Lafayette	610	150	8½	3.45
Fort Wayne	510	140	8	4.50
*New Albany	400	153	5	3.50
*Madison	314	120	6	4.85
*Jeffersonville	240	105	5	4.00
Logansport	256	59	3	4.00
La Porte	240	86	4	4.20
°Franklin	150	..	4	7.00
°Columbus	150	..	4	4.00
*Aurora	80	..	4	4.09

° Franklin and Columbus are new works, and are merely approximated. R.

[The above list will be interesting and valuable to our patrons and readers, we doubt not. Our friend, "R," has placed us under obligation for the information, and we hope he may continue his favors.—Eds.]

Will Naphtha do for Wet Meters?

GAS WORKS, SEDALIA, MO., Aug. 10, 1870.

MESSRS. Editors: Would naphtha do for wet meters in winter? What effect would it have on the gas or meter? Please let me have your opinion, and much oblige yours, etc. J. F. HATES, Manager.

[Neither "naphtha," so called, nor petroleum (of which it is the more volatile constituent) would be useful as a liquid for filling gas-meters. The solubility of naphtha-vapor in the gas, and the solubility of the gas itself in petroleum, would, in any supposable practical case, more than neutralize any imaginary advantages derivable from the use of these liquids.—H. W.]

Feeding Steam Boilers.

A recent English invention for feeding steam boilers or generators with water, by the use of an automatic apparatus, consists of a heating or boiling close vessel, into which the supply water is filled either hot or cold, by the mere flow or slight head of gravitation supply (without the necessity of a pump or other forcing apparatus) intermittently by a reverse siphon construction, of pipe, with a regulating valve open or allowed to open by a float falling when the water is low in the boiler or generator, and the force of the inlet water through the siphon and valve, until the feeding vessel is full, or nearly so, the water being then heated within the feeding vessel until the steam rises above or equal to the pressure of the steam within the boiler or generator, when the water would then flow or gravitate into its water-space through a pipe and valve connecting the lower part of the feeding vessel therewith.—*Exch.*

Recent American Patents.

Pertaining to the Specialties of this Journal, for the two weeks ending August 27, 1870.

106,312.—Steam Pumping Engine.—T. Blunt, Brookfield, Ohio.

106,380.—Portable Gas-Pipe Vise.—Thomas Marshall, Paterson, N. J.

106,388.—Steam Generator.—J. A. Miller, New York city.

106,389.—Carburetting Apparatus.—Joseph Millward, Fayetteville, N. Y.

106,392.—Steam Generator.—D. A. Morris, New York city.

106,400.—Governor for Steam Engine.—A. J. Pervey (assignor for three fourths of his right to G. F. Pottle), Boston, Mass.

106,424.—Water Pipe Machine.—J. W. Stockwell, Portland, Maine.

106,441.—Rotary Steam Plow.—J. T. Wilson, Rochester, N. Y.

106,497.—Steam Engine.—Hermann Mohr, New York City.

RECENT ENGLISH PATENTS.

[From the LONDON ARTIZAN, Aug. 1. 1870.]

1818.—Steam Engines.—V. Rastouin.

1843.—Steam Generators.—A. M. Clark.

1872.—Purification of Gas.—T. Gray.

1967.—Carburetting Gases.—B. Hunt.

1983.—Steam Generators.—W. Spence.

1989.—Steam Etgines.—J. Humphrys.

2024.—Purification of Gas.—W. S. Bently and W. Isham.

2032.—Construction of Boilers.—J. N. Paxman and H. M. Davey.

2071.—Gas Regulators.—T. Higgs and J. Elliott.

Appearance of the Bessemer Flame.

In the Bessemer process the appearance of the flame, either as seen by the eye or examined through the spectroscope, furnishes the indications by which the progress of conversion and the time for ceasing the air-blast are made manifest. The following description of the flame is made from the May number of *Van Nostrand's Magazine:*

"At the commencement of the process no real flame appears, but only an illumined streak of gas containing numerous reddish sparks, which are mostly little pellets of iron. After a few minutes an orange colored flame of low luminous power and transparent, is formed; a few blue stripes appear in it, and a whitish border is now and then seen on its edge. Gradually sparks of burnt iron and fragments of white-hot slag are mixed with it; its brilliancy is increased, and the stream of gas, at first steady, becomes irregular and fitful. In the second period the flame is very bright, almost white; is very luminous, and contains numerous sparks of iron and pellets of slag, which are sometimes ejected in a sheaf like shape. A violent, reckless flickering of the stream of gas only decreases at the end of the period, while the flame is brightest. With the commencement of the third period the eruptions become less frequent, without a diminution in the luminous power of the flame. After a few minutes, however, this becomes weaker, and the flame appears more transparent, and contains blue and violet colors plainly intermixed. Only in the working of certain qualities of pig iron (dark gray manganiferous iron) does the flame remain strongly luminous till the end of the charge (for instance, at Hörde). At the close of this period the flame suddenly ceases, and a transparent stream of gas, illuminated from within, is steadily expelled out of the mouth of the converter. At this point the process is interrupted. In the second period, and with some qualities of iron (especially if taken directly from the blast furnace), even in the first, the flame is mixed in a greater or less degree with a brown smoke, more seldom with a whitish or yellowish smoke. In this last period this smoke quite frequently appears in such quantities (as, for instance, at Königshütte) that even the existence of a flame can be scarcely observed. In this case it is of course very difficult to determine the time of the disappearance of the flame.

"With the addition of the spiegeleisein, for the purpose of bringing the decarbonized iron back to steel, and if the blast at the same time be shut off, we notice an orange-yellow sooty flame, which, on again admitting the blast, changes into a flame resembling in color and appearance that which is seen at the commencement."

MISCELLANEA.

According to M. Saint Deville, the oxygen dissolved during the fusion of platinum causes the metal to spirit as in the case of molten silver.

Peat.—According to the Marquette *Mining Journal* the peat works there are still in active operation and the fuel manufactured is coming into general use at Ishpeming. It is now being used with success at the Superior foundry, and, says the *Journal*," we shall be very much disappointed if its utility in the blast furnace is not demonstrated to a certainty, before the close of the season."

The Presence of wood fiber in paper can be detected by means of some salt of aniline. A weak aqueous solution of sulphate of aniline is the best re-agent for this purpose, as it gives an intense yellow color if the paper contains no more than a few per cent. of woody fiber; but the test is only applicable when the wood has been prepared in a mechanical way; chemically prepared wood does not yield the same re-action.

The sewage question is now agitating the cities of England, and the problem how to dispose of the refuse and garbage without incurring the danger of pestilence. The *savans*, it is alleged, hope that the waste of London, instead of polluting the Thames, as it now does, will soon be regularly turned into "good milk and vegtables" or even strawberries and cream.

The French and Dutch were the first to use blast furnaces; they were about 10ft. high, charged with ore and coal at the top in alternate layers. The blast was introduced at the bottom. The exact time of their invention is not known; subsequently blast furnaces were built 25ft. high on the Rhine. At these furnaces cannon were cast in one piece and stoves made, in the fifteenth century.

The amount of coal, transported from the Lehigh region over the railroad and canals, last week, (July 13th) were 116,409.10 tons, against 100,971.99, the week preivous, an increase of 15,438.01 tons, and an increase over the corresponding week last year of 87,056.05 tons From the Schuylkill region the amount transported for the whole year is 1,140,304.02 to the same time last year, 1,421,392.05, showing a decrease of 287,038. 04.

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SAMUEL P. PARHAM, Engineer Mutual Gas-Light Company, N. Y.
Prof. HENRY WURTZ, Editor Chemical Department GAS LIGHT JOURNAL
HENRY J. DAVISON, Engineer, 77 Liberty Street, N. Y.
HERRING & FOYD, Oregon Iron Foundry, 738 Greenwich Street, N. Y.
FREDERICK SABBATON, Engineer Troy Gas-Light Company, Troy, N. Y.
COL. WHITE, Engineer, People's Gas-Light Company, Williamsborgh, N. Y.
GEORGE W. PARSONS, Sup't and Eng'r, Rochester Gas-Light Co., Rochester, N Y,
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*** Reference to them is requested. 204-1y

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

FRIDAY, SEPTEMBER 2, 1870.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER. The registration fee has been reduced to fifteen cents, and the registration system has been found by the postal authorities to be virtually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested to do so.

CONTENTS.

☞ An asterisk (*) denotes an illustrated article.

Improved Vertical Engine 65
The Magnetic Well of Michigan 65
Chemical Repertory 66
Practical Management of Gas Works 67
On Setting and Working Retorts 67
*The Chemical History of a Candle 68
Monthly Report of the Hartford Steam Boiler Inspection and Insurance Company 69
Gas from Peat 69
Economizing Fuel 69
CORRESPONDENCE—
Commendatory Opinion of our Patron 70
Gas Companies in Indiana 70
Will Naptha do for Wet Meters 70
Feeding Steam Boilers 70
Recent American Patents 70
Recent English Patents 70
Appearance of the Bessemer Flame 70
Miscellanea 70
GENERAL EDITORIALS—
Disclaimer 72
The Murphy Run Coal 72
Smedberg's Synopsis of British Gas-Lighting 72
Practical Management of Gas Works 72
Cremin's Patent Champion Gas Burner 72
About Exhausters and Governors 73
Gas Manufactured in New York 73
McMillin's Purifying Dust 73
Mr. William Farmer 73
Improved Steam Engines 73
Answers to Correspondents 73
New Publications 73
Coal Dust 73

SITUATION WANTED.—A GAS ENGINEER of nearly twenty years experience in Building and Managing Works, is now open for an engagement. Undoubted reference furnished as to ability and moral character. Address, ENGINEER, office of this Journal, or Box 1513, New York P. F.

GENERAL EDITORIAL.

DISCLAIMER.

Our esteemed contemporary, the *Journal of Applied Chemistry* (for August, page 121,) does the writer of this note too much honor, in ascribing to him, by name, and in a very prominent manner, the description recently in our columns of the new "Saratoga Process" of gas-making; of which the writer is as yet entirely without knowledge, except through Mr. CALLENDER's description, quoted by our contemporary Thanking the latter therefore for his courtesy, I would respectfully call his attention to the notice at the head of these columns, relating to the responsibility taken by me for articles contained therein. HENRY. WURTZ.

THE MURPHY RUN COAL.

On the occasion of the communication of the results of the analysis of the gas made by the Harlem Gas-Light Co., from the coal of these mines exclusively, without admixture with other coal; it was stated that an analysis of the coal itself was being made, and would be presented. We are at last enabled to make room for these additional results; and find therein occasion for the introduction of some general observations.

It has already been stated that the Murphy Run is one of that class of coals in West Virginia which, while rich in ingredients furnishing gas of very high illuminating power, is at the same time so highly charged with iron sulphuret that the ordinary method of dry-lime purification becomes, at least on a very large scale, and in cities, almost impracticable.

It was costly experience of this which led to the abandonment at the Harlem Works, during the last Spring, of the use of lime, and the adoption of the iron process, in the highly improved modification of ST JOHN and CARTWRIGHT, which is now (after the overcoming of some of those practical difficulties which beset all innovations, in every branch of human enterprise), in most successful application at these Works; the illuminating power of the gas ranging, according to different observers, from seventeen to eighteen candles, for an average make of 4.6 feet per lb. or 10,300 feet per ton.

The Murphy Run coal has, however, to the certain knowledge of the writer, furnished, in most skillful and reliable hands, when perfectly purified by lime, a gas of 20 22 candle power, for a yield of 9.930 feet per ton; equivalent to a total result about eight per cent. greater than a 10.300 foot yield of 18 candles. The difference is readily accounted for by the results of the analysis of the gas made by the undersigned, and already laid before our readers (See this Journal of June 2, 1870); from which it will be seen that the iron, as was to be anticipated, left some carbonic acid in the gas, the amount in this case, however, being surprisingly small, that is, but 1.17 volume per 100. Now according to the experiments of ALEXANDER WRIGHT, which we have already discussed, this proportion of carbonic acid, in a gas richer than this, however, should produce a deterioration of between seven and eight per cent.

It is therefore a matter of reasonable anticipation that such further improvements of ST. JOHN and CARTWRIGHT's methods, as will lead to the removal of this small residual amount of carbonic acid, will give us, from the Murphy Run Coal, over 10,000 feet of a 20 candle gas. As now conducted, however, by the Harlem Co., the improvements in purification already effect a very great economy, with this coal, over the use of lime, as we have before demonstrated.

It was our observations of the working of this new iron process, at the Harlem Works, that first led us to anticipate, and to predict in these columns, a great future for this improvement. Recently, however, the inventors, and others, have laid before us practical results, obtained at other Works; among others, at Worcester, Mass.; which indicate a degree of *endurance* of action on the part of ST. JOHN and CARTWRIGHT's compound, so great as to be almost incredible, and even beyond the expectations of the inventors themselves. We hope to be authorized, at an early day, to lay the details before our readers.

Room is left only to conclude with the statement of the analysis of the coal of Murphy Run:

Volatile Matter			38.30
Coke	Fixed Carbon	55.81	61.70
	Ash	5.89	
			100.00

The coke was of excellent quality, amounting to about 36 bushels, and about 1450 lbs. per long ton. It burns well, but makes a little clinker, owing to the sulphuret of iron present. H. W.

SMEDBERG'S SYNOPSIS OF BRITISH GAS-LIGHTING.

Subscribers to the above entitled work are assured, that though a delay took place in the publication, it will now shortly be placed in their hands, as, from a recent letter received from Mr. Smedberg, he therein states that the compilation of the same is finished. It will be a consolidation of the most valuable portions of the "London Gas-Light Journal" into a single volume; also other very interesting matter to gas men.

A work of this character cannot fail to be of great value to Gas Engineers, and the opportunity should not be lost in securing it, as only a limited number of copies will be published.

Mr. Smedberg's familiarity with all matters pertaining to gas and gas works, make him especially qualified for the execution of so important a work.

We would therefore call the attention of those who have not yet subscribed to do so at once, as now is the time to get it at subscription price, which is $15. See advertisement on page 73.

PRACTICAL MANAGEMENT OF GAS WORKS.

Our readers will, no doubt, be pleased to perceive, in the present issue of the Journal, that Mr. Smedberg has resumed his very interesting articles on the "Practical Management of Gas Works," the preceding seven numbers of which was published in this Journal, from January to April, 1868.

Owing to the onerous duties of Mr. Smedberg, as Consulting Engineer of the San Francisco Gas Works, he was unable, heretofore, to fulfil his promise of corresponding for the Journal; however, "better late than never," and we shall be happy to place before our readers, any articles emanating from one, whom we know to be fully capable of imparting useful information, on all matters pertaining to gas. Mr. S. also assures us that the Synopsis is now finished, and will be forwarded: also some other very important matters.

CREMIN'S PATENT CHAMPION GAS BURNER.

At a recent meeting of the Board of Aldermen, held at the City Hall, a majority being present and Alderman Coman in the chair, after the usual routine of business had been gone through, Alderman Waltman moved to take from the table the veto message of the Mayor on the resolution of the Board, passed July 7, 1870, which was read as follows:

"*Resolved*, That the Commissioner of Public Works be and is hereby authorized and directed to procure and attach to each of the public gas lamps in the streets, lanes, alleys, highways and public places within the corporate limits of the City of New York, one of Cremin's Patent Champion Gas Burners and new improved patent street lamp reflectors, provided the expense thereof shall not exceed fifteen dollars for each lamp.

The resolution was then put and passed, notwithstanding the objections of the Mayor.

The cost of the burner and reflector together is reasonable, and will greatly improve the light of our streets and byways.

ABOUT EXHAUSTERS AND GOVERNORS.

REPUBLICATION.

An article under the above heading, appeared as Editorial in our issue of August 16th, 1860, but owing to the fact that that edition is exhausted, and we are having orders for copies containing the article mentioned, we have decided to republish the same, with addenda. We do this more readily, because the new Exhauster Governor referred to, is a matter that is of interest to all Gas Companies that are using Exhausters; and by many of them entirely unknown.

GAS MANUFACTURED IN NEW YORK.

The following table will show the amount of Gas manufactured by the different Gas Light Companies, in the City of New York, during the month of July:

GAS COMPANIES.	
Metropolitan Gas-Light Company . .	15,565,432
Harlem Gas-Light Company . . .	5,369,972
New York Gas-Light Company . .	29,451,460
Manhattan Gas-Light Company . .	54,333,427
	104,720,291

McMILLIN'S PURIFYING DUST.

We understand the Columbus, Ohio, Gas Works, are using McMillin's Purifying Dust, with great satisfaction. About 30 bushels being sufficient to purify 5,000 cubic feet of gas per day, continuously, and without any addition or renewal.

It seems that the days of Lime purification are nnmbered, and in a short time no one will be found "to do reverence" to that disagreeable and labor exacting *autocrat* of the gas works.

MR. WILLIAM FARMER.

We desire to call attention of the gas fraternity to the advertisement of Mr. Wm. Farmer, on page 71, who solicits their patronage.

His numerous references give ample evidence of his ability to turn out good work, with despatch and satisfaction; and we feel a pleasure in adding, that from our own personal knowledge, we can safely state that he is perfectly *au fait* in his profession, and would refer to him all who are desirous of his services.

IMPROVED STEAM ENGINES.

There is no class of improvements of greater importance to all industrial interests, than that relating to the economical and efficient application of steam power. A compact, easily managed, and durable engine, which can be run without waste of fuel, or the employment of trained skill to keep it in order, is an acknowledged desideratum to manufacturers of all kinds. The attention of such is called to the vertical engine illustrated on our front page, for which numerous advantages are claimed over the common styles of engines, and which, from its simplicity of construction and elegance of design, is commended to those wishing an efficient motive power at reasonable cost.

NEW PUBLICATIONS.

Inventors and Manufacturers Journal.—This Journal now enters on its 3rd volume, and is enlarged to 16 pages, which makes it more convenient for binding. Among its new features are Biographical Sketches of eminent men (with illustrations); the illustration of new inventions for the shop, household, and farm; the Manufacturers Market Report, and the issue of a German edition, uniform with the English edition. The publishers aim to make it deserving the liberal patronage with which it has already been favored, and to keep it in the foremost ranks of the progress that marks our times. Published by T. Van Kimmel & Co. 131 West 4th st, Cincinati, Ohio. Subscription for either editions $1 per annum.

The Engineer.—A new Scientific Journal of 16 pages, published by Wm. C. Lewis, 19 Courtlandt st., New York. It is well got up, and contains many illustrations of improvements in machinery, with much useful reading matter for the class for which it is designed—the interest of property-owners, manufacturers, inventors, mechanics, engineers, and scientific men generally. Subscription, $1.50 per annum.

Answers to Correspondents.

C. A. B., of Ohio.—The difficulty you complain of is experienced in many gas works. The cause of the deposition of carbon is that too great pressure is maintained on the retorts. When the gas is removed as fast as generated very little carbon is deposited. You should procure an exhauster, and we are confident you would find the use of this instrument would amply repay the money laid out in its purchase. The substance like "putty" must be naphthaline, which would seem to indicate your gas is not fully condensed.

C. O. A., of Ind.—Clay retorts usually leak for a short time after being used owing to the porosity of the material of which they are made. The pores, however, soon become choked up with carbon, and little or no loss afterwards ensues.

J. E. F., of Ohio.—Your views are not new. The right to make gas in the way you describe, has already been patented.

B. B., of Phil.—We will have to send to Europe for a copy, which may consume about six weeks. None can be obtained here.

L. E. L., of Mass.—Your views are correct. We will attend to your request, and forward the articles by mail.

G. P., of N. J.—Hughes' work on Gas has not been republished in this country. You can buy a copy of the English edition of D. Van Nostrand. It is about the best rudimentary work on the subject.

Coal Dust

Although many attemps to consolidate coal dust so as to render it economical as fuel have been made, none have we believe been able to so utilize it except where it is already transported to trade centers. It would seem, however, that there have been bidders for the great dust heaps in the Pennsylvania coal regions. The New York *Times* in a recent articl says the deposits of coal dust in these regions have grown into immense mountains—a burden to the proprietors, and a snare for unwary speculation. One of these, of unusally enticing bulk, has been sold, over and over again, to ingenious capitalists, chiefly from the Eastern states, and of the *Toodles* pattern. They bought the dust pile because it was cheap for its very apparent worthlessness, suggested immense, if vague, possibilities of honest pennies. But the purpose has already been abandoned in despair by one after another of these misguided financiers. One, indeed, conceived the brilliant idea of sifting his mountain for the solid coal scattered through it and after procuring an army of carts, and working zealously for a week, readily obtained a tun or two of admirable coal. As he ascertained, however, that his sifted coal cost about three times per tun what he would have to pay at the mines, he sagaciously concluded that his undertaking was less profitable than laborious, and so gave it up and fled.—*Sci. American.*

A SYNOPSIS OF

BRITISH GAS LIGHTING.

To be Published Shortly.

"WINNOWED.—The wheat carefully preserved, and the chaff thrown away."

This work will comprise the essence of the London *Journal of Gas-Lighting*, from February 10, 1849, to December 31, 1867, and afford a succient resume of the entire English Gas Engineering between these dates.

The excerpts will, as far as possible be symmetrically arranged under the heads of Coals, Distillation, Purification, Volumetry and Photometry.

It is to be executed by JAMES R. SMEDBERG, Engineer San Francisco Gas-Light Company. Subscriptions should be addressed to the offices of the AMERICAN GAS-LIGHT JOURNAL, 42 Pine st Room 18, New York.

It will be issued only to subscribers.

It will be of great value, not only to Gas Companies and Engineers, but to those who represent the enormous collateral interests of Gas Lighting—to chemists, Gas-Fitters and Patentees, as well as to scientific men generally.

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SUCH REQUIRING A FIRM TO INTRODUCE their Goods by means of Special Agents in Europe, will please quote lowest prices, and full particulars, to JOHN BAILEY, & CO. Engineers, Sundrymen and Brass Founders, Albion Works, Salford Lancashire, England.

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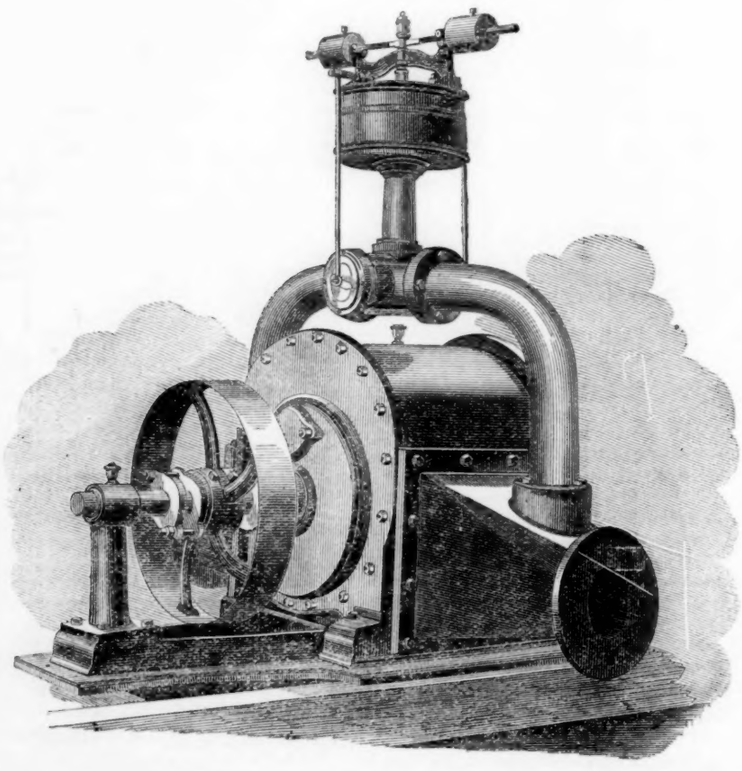

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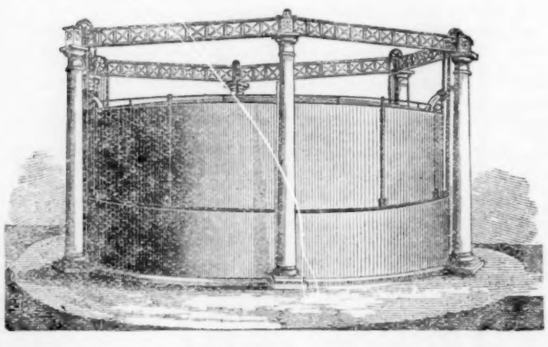

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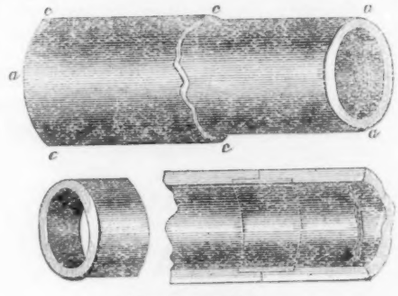

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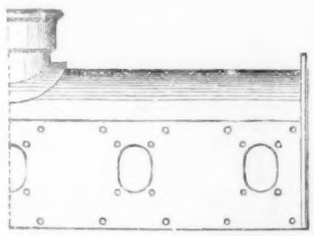

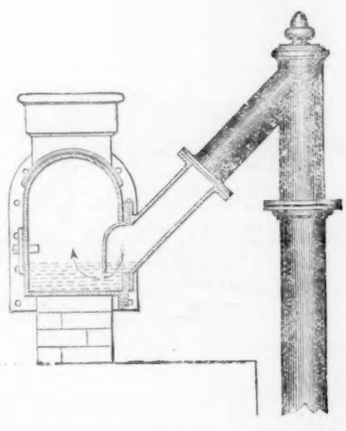

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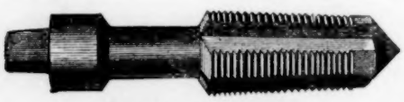

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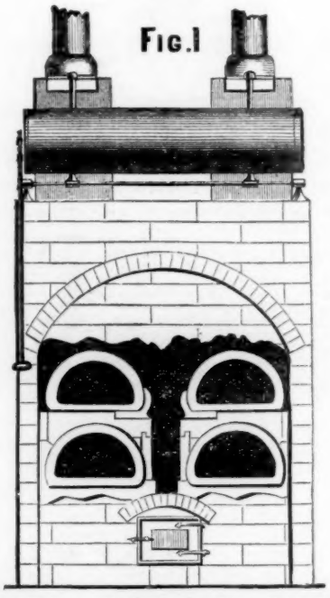

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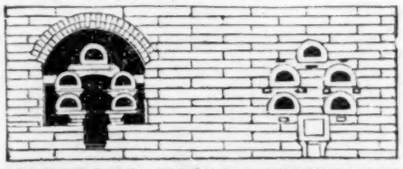

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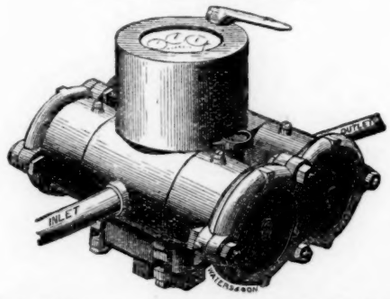

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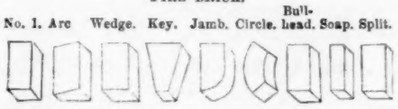

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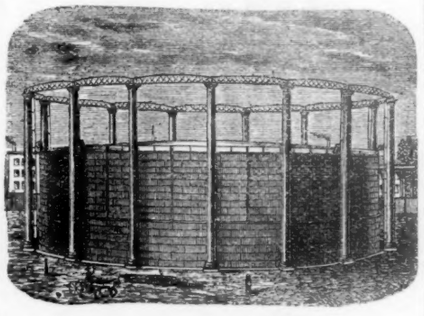

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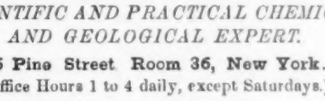

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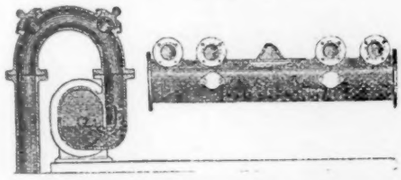

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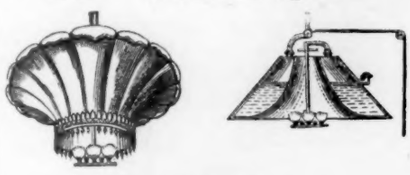

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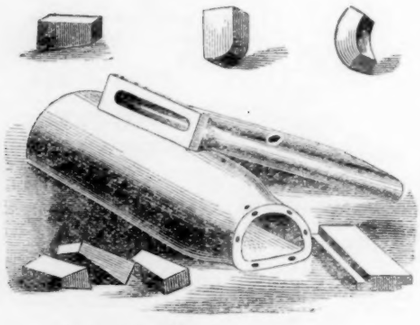

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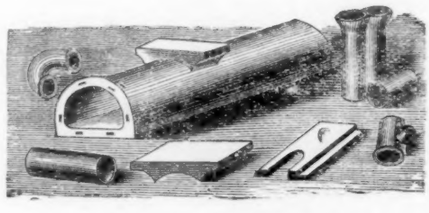

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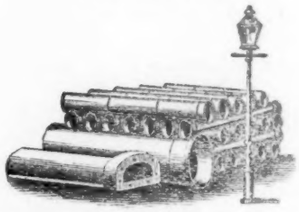

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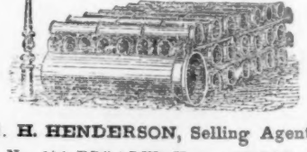

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Advertising Index.

☞ In looking for advertisements, see figures 1 to 9, within brackets, at head of advertisement pages.

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Cambridge Gas Stoves, Ranges, &c.—Gas Light Journal Offices, 8
Contractors for Gas-Works, Etc.—Murray & Baker, Fort Wayne, Ind 9
Champion Gas Burner—Cremin & Co., 958 Third Ave., N. Y... 8
Fairmont Gas Coal Co.—Office, 47 Exchange Place, N. Y 8
Gas Retorts, Etc —George C. Hicks & Co., Baltimore, Md..... 9
Gas Fixtures, Etc.—Archer & Pancoast Manufacturing Co., 9, 11 and 13 Mercer street, New York..... 6
Gas Engineers and Contractors—Hoy, Kennedy & Co., 111 Liberty street, New York..... 5
Gas-Burners—C. Gefrorer, 529 Commerce street, Philadelphia, Pa..... 9
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry street, Philadelphia, Pa..... 8
Gas Producing Materials—John K. Truax & Co, Pittsburgh, Pa. 3
Gas Apparatus, &c.—Geo. H. Kitchen & Co., 561 Broadway... 9
Gas Burners—T. G. Arnold, 224 and 226 West 21st st., N. Y. .. 9
Gasometers, Etc—George Stacey & Co. Cincinnati, O..... 6
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway..... 4
Gasholders, Etc.—Delly & Fowler, 39 Laurel street, Philadelphia 6
Gas and Water Pipes—R. D. Wood & Co., Phil..... 2
Gas and Water Pipes—B. S. Benson & Son, Allentown, Pa..... 7
Gasometers, &c.—Keystone Iron Works—2132 Filbert st., Phil. 4
Gas and Kerosene Fixtures—Tucker Manufacturing Company, 39 and 41 Park Place, N. Y., and 119 Court street, Boston.... 2
Jersey City Gas Meter Works. 14 Morris st., Jersey, N. J. 5
Ludlow Valve Mf'g Co., 193 River street, Troy, N. Y 4
Lava Gas Tips, etc., etc.—James J. Walworth & Co., 2 Bath st., Boston, Mass..... 9
Oil and Rosin Gas Works—John Butler, 126 Maiden Lane, New York..... 2
Patent Conically Closed Wood Trays—John L. Cheesman, 147 and 149 Ave. C, N Y 5
Patent Gas Exhauster—Smith & Sayre, 95 Liberty st..... 4
West Fairmount Gas Coal Mines, Office, Baltimore Md..... 9
Wooden Gas and Water Pipe—Wyckoff Bros. & Co., Elmira.... 4

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Gas Coals—Bird, Perkins & Job, 86 South street, New York..... 2
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The Newburgh Orrel Coal Company—Chas. W. Hays, Agent in New York, Trinity Building, 111 B'way, Room 7..... 2

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Brooklyn Tube Works—B. T. Benton, Brooklyn..... 8
Columbian Iron Works—Wm. Taylor & Sons, 11, 13 and 15 Adams street, Brooklyn, N. Y..... 7
Cast Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md..... 8
Continental Works—T. F. Rowland, Greenpoint..... 7
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Sons... 7
Gloucester Iron Works, Camden, N. J..... 7
Louisville Pipe Works—Dennis Long, Cor. 9th and Water-sts., Louisville, Ky..... 8
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman and Wilkins streets Pittsburgh, Pa 7
Oregon Iron Foundry—Herring & Floyd, 738, 740, 742 and 744 Greenwich street, New York 9
Pascal Iron Works—Morris, Tasker & Co., Philadelphia, Pa... 9
Retorts, Pipes, &c.—R. D. Wood & Co., 400 Chestnut street, Philadelphia 3
Southwark Foundry—Merrick & Sons, Fifth and Washington Streets, Philadelphia..... 9

WATER METERS, PUMPS, ETC.

Ashcroft's Low-water Detector, 50 John street, New York..... 7
Aubin Water Meter—H. Q. Hawley, Albany, N. Y..... 8
Cast Iron Gas and Water Pipe—Smith & Ellis, York and Moyer streets, Philadelphia 8
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Steam Pumps—H. R. Worthington, 61 Beekman st, New York.. 8
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Worthington's Water Meters—H. R. Worthington, 61 Beekman street, New York..... 7

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Jersey City Fire Brick Works.—J. H. Gautier & Co., Greene, Essex and Bergen streets, Morris Canal Basin, N. J..... 5
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Gas-Light Journal American and Foreign Patent Agency... ...10
Professor Henry Wurtz Office Gas-Light Journal..... 2
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